Docket No. AT9-98-916

METHOD AND APPARATUS FOR AUTOMOTIVE RADIO TIME SHIFTING
PERSONALIZED TO MULTIPLE DRIVERS

5   ## BACKGROUND OF THE INVENTION

1. Technical Field:

The present invention relates to a vehicle onboard
computer system for controlling various vehicle onboard

10 systems and subsystems. More specifically, the present
invention relates to a system and method for implementing
user specific preferences on the vehicle onboard computer
system for regulating the operation of a vehicle audio
subsystem. Still more particularly, the present

15 invention relates to a system and method for identifying
and authorizing users and implementing user specific
parameters associated with the users with respect to the
storing and playback of broadcast events.

20 ### 2. Description of Related Art:

It has been well known in prior art to limit the
access and operation of a vehicle by granting authority
of the user to operate a vehicle with such devices as a
mechanical key. In the prior art, any person who

25 obtained the mechanical key could generally operate the
vehicle.

As the sophistication and comfort of the vehicles
increased, the number of vehicle systems and subsystems
increased proportionally. The audio subsystem of a

Docket No. AT9-98-916

vehicle provides the vehicle operator with entertainment
that eases the boredom associated with the mundane
routine of operating the vehicle. In addition, news,
traffic and weather broadcasts allow the user to better

5   plan a safer and more efficient route. One problem
associated with prior art audio subsystems is that the
audio preferences are not indexed by user. Other
problems are that the user might not be aware of the
exact broadcast time of a broadcast event or the user

10   might be preoccupied with operating the vehicle and
unable to tune the audio receiver to the broadcast
frequency. Therefore, it would be advantageous to have
an improved method and apparatus for adjusting user
specific preferences for recording and playback of

15   broadcast events in a vehicle.

Docket No. AT9-98-916

SUMMARY OF THE INVENTION

5   A plurality of users each selects desired listening broadcast programs that are recorded by a system in a memory and indexed to the specific user. The user may also select the desired playback schedule and playback format. Conveniently, the system retrieves recorded

10   broadcast programs stored in memory, then plays them according to the specific user's desired format and schedule. Additionally, each user may select which broadcast programs are stored, which broadcast frequencies are scanned by the system for the desired

15   broadcast programs, and how long each broadcast program is stored in memory.

Docket No. AT9-98-916

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the

5   invention are set forth in the appended claims. The
invention itself, however, as well as a preferred mode of
use, further objectives and advantages thereof, will best
be understood by reference to the following detailed
description of an illustrative embodiment when read in

10   conjunction with the accompanying drawings wherein:

Figure 1 depicts a block diagram illustrating a data
processing system of the present invention.

Figure 2 depicts onboard systems of the present
invention as defined in a preferred embodiment of the

15   present invention.

Figure 3 illustrates the suspension and ride system
of the vehicle.

Figure 4 illustrates the comfort system of the
vehicle.

20   **Figure 5** illustrates another system under the
control of the onboard computer, the
communications/interface system.

Figure 6 illustrates another system under the
control of the onboard computer, the navigation and

25   tracking system.

Figure 7 illustrates another system under the
control of the onboard computer, the audio system.

Figure 8 illustrates the safety system as
implemented in the present invention.

Docket No. AT9-98-916

Figure 9 illustrates the engine performance system as related to the present invention.

Figure 10 illustrates the user interface system as implemented in the present invention.

5   **Figure 11** depicts another embodiment of Audio system **700** as defined by the present invention.

Figure 12 depicts the process of the present invention.

Figures 13A and **13B** illustrate the playback mode of

10   the present invention.

Figure 13B illustrates the playback mode of the present invention in more detail.

Figure 14 illustrate the data structure stored in memory of the present invention.

15   **Figure 15** illustrates the user ID data structure.

Figure 16 illustrates the verification data structure.

Figure 17 illustrates the security level data structure.

20   **Figure 18** illustrates an extremely abbreviated data structure of possible preferences.

Figure 19 illustrates the preference limits data structure.

Figure 20 illustrates the data structure of user

25   logged data.

Figure 21 illustrates an example of how the onboard computer authorizes user preferences by user security level.

Docket No. AT9-98-916

Figure 22 illustrates an example of a set of user specific preferences for the audio system.

Docket No. AT9-98-916

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

5   The present invention provides for a method and means
for implementing user specific preferences to onboard
systems on a vehicle. Heretofore user specific
preferences were unknown because the onboard systems could
not discriminate between users' identities but would
10   instead discriminate between access keys, either
mechanical or personal identification numbers. The
present invention incorporates user verification for
positively verifying the user and indexing user specific
preferences to that user whereby the user need not make
15   adjustments to the various onboard systems each time the
user accesses the vehicle. The present invention is
described herein with reference to a preferred embodiment
of the onboard systems (**Figures 1** to **11**), a process for
practicing the present invention implemented on the
20   onboard system (**Figures 12** and **13**) and finally, with
respect to an embodiment of a data structure used in
conjunction with the process (**Figures 14** to **22**).

       With reference now to **Figure 1**, a block diagram
illustrates a data processing system in which the present
25   invention may be implemented. Data Processing system **100**
is an example of a client computer. Data Processing
system **100** employs a peripheral component interconnect
(PCI) local bus architecture. Although the depicted
example employs a PCI bus, other bus architectures such as

Docket No. AT9-98-916

Micro Channel and ISA may be used. Processor **102** and Main
Memory **104** are connected to PCI local Bus **106** through
Host/PCI Cache/Bridge **108**. Host/PCI Cache/Bridge **108** also
may include an integrated memory controller and cache
5   memory for Processor **102**. Additional connections to PCI
local Bus **106** may be made through direct component
interconnection or through add-in boards. In the depicted
example, Local Area Network (LAN) Adapter **110**, SCSI Host
Bus Adapter **112**, and Expansion Bus Interface **114** are
10 connected to PCI local Bus **106** by direct component
connection. In contrast, Audio Adapter **116**, Graphics
Adapter **118**, and Audio/Video Adapter (A/V) **119** are
connected to PCI local Bus **106** by add-in boards inserted
into expansion slots. Expansion Bus Interface **114**
15 provides a connection for a Keyboard and Mouse Adapter
120, Modem **122**, and additional Memory **124**. Additional
Memory **124** may consist of any type of memory including
flash memory. SCSI Host Bus Adapter **112** provides a
connection for hard Disk drive **126**, Tape drive **128**, and
20 CD-ROM drive **130**. Typical PCI local bus implementations
will support three or four PCI expansion slots or add-in
connectors.

   An operating system runs on Processor **102** and is used
to coordinate and provide control of various components
25 within Data Processing system **100** in **Figure 1**. The
operating system may be a commercially available operating
system such as OS/2, which is available from International
Business Machines Corporation. "OS/2" is a trademark of
International Business Machines Corporation. The

Docket No. AT9-98-916

operating system may also be a real time operating system (RTOS), such as QNX Neutrino™ from QNX Software Systems Ltd., 175 Terranence Matthews Crescent, Kanata, Ontario, Canada K2MLW8. An object oriented programming system such

5   as Java may run in conjunction with the operating system and provide calls to the operating system from Java programs or applications executing on Data Processing system **100** via a Java Virtual Machine. "Java" is a trademark of Sun Microsystems, Inc. Instructions for the

10 operating system, the object-oriented operating system, and applications or programs are located on storage devices, such as hard Disk drive **126**, and may be loaded into Main Memory **104** for execution by Processor **102**.

Those of ordinary skill in the art will appreciate

15 that the hardware in **Figure 1** may vary depending on the implementation. Other internal hardware or peripheral devices, such as flash ROM (or equivalent nonvolatile memory) or optical disk drives and the like, may be used in addition to or in place of the hardware depicted in

20 **Figure 1**. Also, the processes of the present invention may be applied to a multiprocessor data processing system.

For example, Data Processing system **100**, if optionally configured as a network computer, may not

25 include SCSI Host Bus Adapter **112**, hard Disk drive **126**, Tape drive **128**, and CD-ROM **130**, as noted by dotted line **132** in **Figure 1** denoting optional inclusion. In that case, the computer, to be properly called a client computer, must include some type of network communication

Docket No. AT9-98-916

interface, such as LAN Adapter **110**, Modem **122**, or the like. For mobile vehicle applications, the preferred network communication interface might be a wireless network circuit for communicating digital packets of

5   information to and from the central fleet server. As another example, Data Processing system **100** may be a stand-alone system configured to be bootable without relying on some type of network communication interface, whether or not Data Processing system **100** comprises some

10 type of network communication interface. As a further example, Data Processing system **100** may be a Personal Digital Assistant (PDA) device which is configured with ROM and/or flash ROM in order to provide non-volatile memory for storing operating system files and/or user-

15 generated data.

The depicted example in **Figure 1** and above-described examples are not meant to imply architectural limitations with respect to the present invention. Although **Figure 1** provides examples of configurations of computer systems

20 on which the present invention may execute, the following background information may provide a context for understanding the overall computing environment in which the present invention may be used.

Figure 2 describes the systems of the present

25 invention as defined in a preferred embodiment of the present invention. In the present invention, the vehicle may contain one or more Onboard Computer(s) **20**. Users control different systems within the vehicle through Onboard Computer **20**. A specific user can only gain as

Docket No. AT9-98-916

much control of a system or subsystem as authorized by
Onboard Computer **20**. A user may fall into one or more
security level(s), for instance, low level security,
master level security, administrator, service attendant,

5   parking attendant or semi-user. The varying levels of
security allow users having different access priorities
to access only the systems authorized by the level of
security that corresponds to the user's security level.
Other, more specialized security levels might also be

10 available for special purpose operation of the vehicle,
such as thief and drunk driver levels which severely
limit access and performance of the vehicle.

Implementing the different security levels is
primarily a software function which authorizes security

15 levels in a series of IF tests in a logic flow. This
software function is an extremely effective means of
implementing security levels because the preferred
embodiment consists of a closed system which is protected
from arbitrary software being installed from unknown

20 sources. Alternatively, each security level could be a
separate level of hardware. Onboard Computer **20** also
contains an onboard computer Memory **22** which would store
the software logic described above. Onboard Computer
system **20** is intended to be exemplary in nature, and it

25 is not intended in any way to restrict the implementation
of this invention.

In one embodiment of this invention, Onboard
Computer **20** controls several onboard systems through its
different security levels. For simplicity, the invention

Docket No. AT9-98-916

is described largely as consisting of two security

levels, low and high, corresponding to two different

levels of user security. One feature of this invention

is that accessing and changing preferences relating to

5   any one of these systems can be done only by the user who

has a corresponding security level for the security level

which controls the specific system.

Taking first the lower level security, a low level

security user may access and change preference settings

10   for one or more of the following onboard systems:

Suspension and Ride system **300**; Comfort system **400**;

Communications/Interface system **500**; Navigation and

Tracking system **600**; Audio system **700**; and Systems

Monitoring system **290** for the above-mentioned onboard

15   systems.

A user possessing a higher security level, such as a

master security level as authorized by Onboard Computer

20, in addition to resetting and adjusting the preference

settings for the systems requiring a lower level security

20   level for access, may also adjust the preference settings

of the systems requiring a higher level of security for

authorization. Higher level security authorization is

required for: Safety system **800**; Engine Performance

system **900**; and Theft Deterrence and Recovery system **210**.

25   **Figure** 3 depicts the suspension and ride system of

the vehicle. The dashed line around the subsystems

depicts which functions are controlled by the system.

Suspension and Ride system **300** and associated subsystems

are controlled by preferences which set functions

Docket No. AT9-98-916

associated with the particular subsystems. Suspension
and Ride system **300** includes Suspension Performance
Tuning **350**. By the user specifying suspension
performance tuning parameters, the vehicle's ride

5 attributes, such as pitch, yaw, roll and stiffness, can
be changed.

As the user is identified through the use of a user
ID via User Interface **28**, Onboard Computer **20** extracts
certain performance settings from onboard Memory **22** which

10 are indexed to the user's name or ID number. These
performance settings include user specific parameters
which are used to modify each of the functions described
above. One example is that a user may prefer a stiffer
ride and may prefer a certain feel when he operates the

15 vehicle. Therefore, the user may select certain
parameters having to do with suspension performance
tuning to affect the vehicle's ride. These parameters
adjust each one of the functions mentioned above
associated with the subsystem in order to give that user

20 the ride which he desires.

Systems Monitoring **290** continually monitors pitch,
yaw, roll and stiffness attributes of the vehicle's ride
and transmits the information to Onboard Computer system
20. In another embodiment of this invention, Systems

25 Monitoring system **290** continually updates the suspension
performance tuning in order to maintain that overall
riding effect desired by the user. Therefore, as
suspension and ride parts such as tires, shocks, struts,
springs and bearings wear, Systems Monitoring system **290**

Docket No. AT9-98-916

monitors each one of the functions for the desired

effect. If the results monitored by Systems Monitoring

system **210** are not within the user's set preference,

Onboard Computer system **20** may attempt to adjust each one

5   of the functions automatically in an attempt to adjust

the ride to the user's desired preferences--in other

words, reset the user specified ride parameters

automatically.

In another embodiment, the user merely sets

10   parameters associated with suspension performance tuning,

and Systems Monitoring system **290** merely monitors the

functions and transfers the functional output to Onboard

Computer **20**. In this embodiment, it is left up to the

user to manually set each one of the ride and suspension

15   parameters, and as the parts of the vehicle change with

respect to wear or damage, the user is expected to

manually update each one of the parameters. Although

this is possible, it is unlikely that the ordinary user

would possess the skill necessary to make those

20   adjustments autonomously, thus requiring Onboard Computer

20 to calculate those functional parameters for the user.

Therefore, while expert drivers such as race car drivers,

mechanics and the like may possess the knowledge needed

to adjust these parameters, the ordinary weekend vehicle

25   operator might rely on a routine stored within Onboard

Computer **20** to make those adjustments.

Figure 4 illustrates another system under the

control of every user, the Comfort system **400**. Comfort

system **400** includes: Air Temperature and Flow subsystem

Docket No. AT9-98-916

410; Seats and Steering Wheel subsystem **420**; and Mirrors
and Windows subsystem **430**. Once the user has been
identified by Onboard Computer **20** via User Interface **28**,
Onboard Computer **20** retrieves user specific parameters
5   from system Memory **22**. Those user specific parameters
are used to adjust the various subsystems of Comfort
system **400**. If a user enjoys the air temperature
somewhat lower and the flow higher than other users, as
the user is identified by Onboard Computer **20**, Air
10   Temperature and Flow subsystem **410** are automatically
adjusted to the user specific parameters stored in Memory
22. Therefore, the user would not have to readjust the
air temperature and flow parameters every time the user
enters the car, but rather merely satisfy identification
15   to Onboard Computer **20**, and Onboard Computer **20** would
retrieve the user's specific user parameters from Memory
22 and adjust Comfort system **400** accordingly.

In the depicted example, other conveniences
controlled by Comfort system **400** include adjusting seats
20   and steering wheel positions, and mirrors and windows for
particular users. As the user's height and proportions
tend to change from user to user, it would be
advantageous for each user to preset such settings as the
seat position setting and the steering wheel position,
25   along with mirror positions and window positions for the
individual user. As the user drives the vehicle, and
climate conditions or tastes change, the user may have
occasion to adjust certain of the above-mentioned
subsystems. As the user adjusts the subsystems, Systems

Docket No. AT9-98-916

Monitoring system **290** notes these adjustments and transmits the adjustments to Onboard Computer **20**. Onboard Computer **20** then may store the adjustments to system Memory **22**. On exiting the vehicle, the user need

5   not reset the various user parameters that were initially stored in Memory **22**, as these have been updated while the user operated the vehicle.

In one embodiment, Onboard Computer **20** merely retains the updated user specific parameters within

10   Memory **22** as the user exits the vehicle, retrieving them again as the user specific parameters when the user is again identified to Onboard Computer **20**. In another embodiment, updates fed to Onboard Computer **20** via Systems Monitoring system **290** are merely transient. In

15   that embodiment, the updates are lost once the user exits the vehicle unless the user takes some affirmative action to save them. In that embodiment, once the user exits the vehicle the updated parameters are lost in lieu of the initial user specific parameters.

20   **Figure 5** illustrates another system under the control of the onboard computer, the communications and interface system. Another system that may be under the control of lower level security users is Communications/Interface **500**. In a fully integrated

25   onboard computer system, the ability to access large amounts of data for the convenience and safety of the operator becomes more and more important. Also, as the complexity of vehicles increases, the maintenance of those vehicles is expedited by allowing access to Onboard

Docket No. AT9-98-916

Computer **20** and the various systems through a specialized maintenance interface.

One embodiment of the present invention, Communications/Interface system **500**, consists of various
5   subsystems as fulfill the various above-mentioned needs. These include: Satellite Com Link **510**; Cellular/PCS communications **520**; Personal Area Network Port **530**; Fleet Docking Port **540**; Maintenance Port **550**; Home Docking Port **560**; and Regulatory Docking Port **570**. Depending upon the
10   intended use of the vehicle, some or all of these communications subsystems may be eliminated or substituted with other types of communications subsystems.

Other subsystems, such as Satellite Com Link **510** and
15   Cellular/PCS communications **520** may contain extensive local memories for holding user specific data like earth link addresses and telephone numbers. Alternatively, earth link addresses and telephone numbers may be stored on a personal memory such as a SmartCard or magnetic
20   swipe card, or in system Memory **22**, and indexed by user.

In one example of the communications subsystems, for instance a fleet vehicle operation, vehicles could be continually tracked via Satellite Com Link **510**. The fleet dispatcher, therefore, could watch the progress of
25   vehicles and goods from the origin to the destination. If the dispatcher detects a delay somewhere along the route, the dispatcher could immediately contact the vehicle through Cellular/PCS **520** link or Satellite Com

Docket No. AT9-98-916

Link **510** to ascertain the problem and try to help the
vehicle operator formulate an alternate route.

Personal Area Network (PAN) Port **530** would be useful
for such things as ascertaining if a vehicle is
5   authorized to, for instance, go through a toll booth.
There, Onboard Computer **20** would automatically link with
a computer at the toll booth via Personal Area Network
Port **530** and communicate to the toll booth computer an
electronic cash account number by which the toll computer
10   could access and debit the cash amount of the toll,
thereby eliminating the need for the driver of the
vehicle to stop the vehicle and pay a toll. This would
also eliminate the need for the driver to carry any cash
while en route; and in fact, the vehicle itself may not
15   even need to have the cash account, as it could merely
link to the home or fleet headquarters and debit a
financial account for the cash.

Another interface particularly helpful in fleet
operation is a Fleet Docking Port **540**. Although in the
20   preferred embodiment, Fleet Docking Port **540** is a
specific hardware port, fleet docking may also be
realized by using the wireless network circuit described
above in reference to **Figure 1**. Fleet Docking Port **540**
would be useful for an operation that tracks several
25   vehicles up to several thousand vehicles. As the vehicle
would enter the home terminal, the vehicle could park for
transfer of cargo or maintenance, or whatever, and then
be linked via Fleet Docking Port **540** to the terminal
computer which in turn would be linked to the main

Docket No. AT9-98-916

operational computer. Thus, as the truck receives maintenance, or on or off loads cargo, the information concerning the prior trip could be downloaded from Onboard Computer **20** Memory **22**, and information pertaining

5 to the next scheduled trip, including maps, itinerary, electronic cash and the like, could be loaded onto Onboard Computer **20** Memory **22**. Vehicle operators could also be authorized and de-authorized for the vehicle.

As noted above, detailed maintenance records are

10 also important, especially as the number of vehicles in a fleet operation increases. Therefore, a specific Maintenance Port **550** would be useful. Maintenance Port **550** would provide instant access to certain files or records and allow for testing of onboard systems

15 simultaneously with other fleet interface operations. While Maintenance Port **550** indicates that, primarily, the access is limited to maintenance of the engine and onboard systems and subsystems, Maintenance Port **550** should also have access to Onboard Computer **20** main

20 Memory **22** to ascertain such things as fuel and mileage logs, distances traveled, environments traveled in and the like. In this way, an expert mechanic could determine the overall maintenance condition of the unit by comparing it to its previous performance.

25 Home Docking Port **560** would also be useful in a fleet operation where the vehicle operator may be required to bring the vehicle home. In that case, the vehicle operator would merely dock the vehicle at the home port and, using the user's home computer, the fleet

Docket No. AT9-98-916

operations could interface with the computer, for

instance while the operator was away or asleep or on

another task.   In this way, Memory **22** in Onboard Computer

20 could be uploaded with pertinent information about an

5   upcoming trip.

Figure 6 illustrates another system under the

control of the onboard computer, the navigation and

tracking system.   Another important onboard system is

Navigation and Tracking system **600**.   A typical Navigation

10   and Tracking system **600** may include GPS **610** for

ascertaining the exact vehicle position via

geosynchronous positioned satellites.   Maps and Databases

620 would probably reside in the system Memory **22**.   Maps

and Databases **620** might also be fairly transient, being

15   uploaded and downloaded as the intended route of the

vehicle changes.   In another aspect of the invention,

Maps and Databases **620** may be downloaded via Satellite

Com Link **510** or Cellular/PCS **520** connection to the

vehicle's home terminal.

20   Navigation and Tracking system **600** may also include

Locator Beacon **630**.   While Locator Beacon **630** could take

many forms and work in cooperation with one of the

communication systems, either Satellite Com Link **510** or

Cellular/PCS **520**, Locator Beacon **630** may be a separate

25   subsystem providing a radio frequency beacon used to

locate the vehicle in case of emergency or possibly to

track vehicle movements within a local area for a fleet

dispatcher.

Docket No. AT9-98-916

Another important set of tracking databases might be Maintenance Log **640** and Driving Log **650**, which are somewhat related. For an expert mechanic to properly maintain a vehicle, it is useful to have within the

5 vehicle's Maintenance Log **640** the prior routes and conditions in which that vehicle was driven. In that way, when the vehicle experiences what appears to be a sudden loss in performance over the last few trips, a master mechanic can examine the log to note if any

10 difference in the driving pattern exists. Along that same vein, Driving Log **650** could also be useful to a master mechanic in examining the actual driving performance of the vehicle driver. Therefore, by carefully examining these two logs, a master mechanic

15 might merely conclude that what appears to be poor vehicle and engine performance can merely be attributed to the change in drivers, driving patterns or routes.

Additionally, Driving Log **640** and Maintenance Log **650** can be used together to assemble data in User Logged

20 Data **2000**, **Figure 20**. User logged data is indexed by user and might contain fields such as the operation of the vehicle, a specific trip and other data. The log could be displayed on User Interface **28** or at the user's home terminal by a user having an administrator security

25 level. User Logged Data **2000** is an extremely useful resource for setting preference limits as shown on data structure **1900**, **Figure 19**.

With User Logged Data **2000**, the performance of each user under a specific security level can be monitored by

Docket No. AT9-98-916

analyzing User Logged Data **2000**, and specific preferences can be set for that user. For instance, if a user appears to be prone to extremely fast accelerations, an administrator examining the Maximum Acceleration field of

5   User Logged Data **2000**, may limit that user. The administrator can limit vehicle acceleration to a more moderate rate by changing 5 feet per second^2 to 3.5 feet per second^2 in the Maximum Forward Acceleration field of Performance Limits data structure **1900**.

10   Working in close association with Navigation and Tracking system **600** would be Communications/Interface system **500** and especially Cellular/PCS subsystem **520**. Additionally, Theft Deterrence and Recovery system **210** and Collision Avoidance subsystem **870** of Safety system

15   **800** could also make extensive use of Navigation and Tracking system **600**.

      In one example, if a vehicle is identified as being stolen or being used in an unauthorized manner, the vehicle can automatically ascertain its position via use

20   of GPS subsystem **610** and Maps and Databases subsystem **620**. Onboard Computer **20** could then use Communications/Interface system **500** to transmit the information through either Cellular/PCS subsystem **520** or Satellite Com Link subsystem **510** to the fleet dispatcher

25   or local authorities. Additionally, once it has been positively confirmed that the vehicle has been stolen, Locator Beacon **630** could be turned on to aid the police in determining the location of the vehicle.

Docket No. AT9-98-916

Another important feature of this invention, Safety system **800**, including Collision Avoidance subsystem **870**, would make extensive use of Maps and Databases **620** and GPS **610** subsystems in the event of an accident. For

5   instance, Collision Avoidance subsystem **870** might, through some combination of events, detect that an accident that is likely to cause injury or death is imminent. In that case, rather than waiting for the accident to actually occur, Onboard Computer **20**, using

10   one of Communications/Interface **500** subsystems, either Cellular/PCS **520** or Satellite Com Link **510**, can place an emergency call to the fleet dispatcher, to the vehicle's home or possibly to the local authorities, such as a 911 emergency call. In that way, once the accident actually

15   occurs and the vehicle becomes inoperable, including Onboard Computer **20**, a distress signal has already been issued by Onboard Computer **20**. If, on the other hand, the accident which was determined by Onboard Computer **20** to be imminent does not occur, or the severity of the

20   accident is limited, the user may merely cancel the imminent distress call.

Of course, under ordinary use, vehicles tend to break down or have mechanical difficulties of one type or another; and somehow, the likelihood is that, when that

25   occurs, the vehicle operator will not have a clear idea of the vehicle's location within a particular driving area. By using the integrated Navigation and Tracking system **600**, the vehicle operator can quickly determine the vehicle's location at the time of the incident and,

Docket No. AT9-98-916

using Communications/Interface system **500**, call either a

dispatcher, mechanic or a service company for aide.

In other embodiments, performance limits may be

adjusted to limit the maximum distance a vehicle is

5   authorized to travel from its home base or in deviation

from a predetermined route of travel. Working in

combination with Safety system **800** and Engine Performance

system **900**, Warnings, Gauges and Lights subsystem **830**

uses visual or audio indicators to gently remind the

10   vehicle operator that the limits of travel are being

exceeded (see **Figure 8**). Finally, when the infraction

becomes critical, the vehicle is gently caused to come to

a stop by reducing the maximum vehicle speed parameter

limit which reduces the vehicle's speed using Vehicle

15   Speed subsystem **920**, **Figure 9**.

However, prudent safety operation dictates that the

vehicle should always be allowed to move very short

distances, such as one hundred feet, just in case the

vehicle operator becomes de-authorized at a point which

20   is unsafe, such as a railroad crossing. This gives the

de-authorized operator an extra measure of distance to

travel.

Finally, a user may be restricted from operating the

vehicle further than a certain number of miles from its

25   home to reduce unauthorized trips and joy riding. A

regular route vehicle may be limited to a prescribed

route of travel and any variation might be strictly

prohibited. However, in most instances the parameters

Docket No. AT9-98-916

are not so strict as to allow the vehicle to be
maneuvered around detours.

   Figure 7 illustrates another system under the
control of the onboard computer, the audio system.
5 Another onboard system which would be particularly
convenient for multiple vehicle users would be Audio
system **700**. Audio system **700** connects to Onboard
Computer **20**, which restricts access to users who do not
possess the required security level. Users such as
10 parking attendants and the like who may be required to
operate the vehicle only for short distances, are not
expected to use the vehicle's audio system. Audio system
700 would allow each operator to select preferred AM/FM
radio stations, compact disks or tape selections for
15 listening. In addition, it would allow the individual
users to select unique preferences for volume levels,
tone and other audio quality settings. Audio system **700**
contains: Volume subsystem **710** for adjusting the volume
of Audio system **700**; Balance subsystem **720** for adjusting
20 the balance between left and right outputs of Audio
system **700**; Fade subsystem **730** for adjusting front and
rear outputs of Audio system **700**; and Tone subsystem **740**
or comparable subsystem for adjusting the frequency
response or spectral response of the outputted sound.
25 Audio system **700** may also include Selector **750**, which
selects the user specific devices such as CD, tape, AM/FM
radio or other possible outputs. Audio system **700** may
also contain CD/Tape Carousel **760**, which stores a variety
of CDs or tapes on a ready-to-use basis, allowing the

Docket No. AT9-98-916

user to merely select from an available selection in CD/Tape Carousel **760** rather than having to reload CDs or tapes. Finally, Audio system **700** could include AM/FM Station Frequencies subsystem **770**, which includes the

5   user's preferred station settings, along with possible station types and a menu of stations in the vehicle's area.

Audio system **700** works in a fashion similar to the other systems in that the user is identified to Onboard

10   Computer **20** via User Interface **28**. Once the computer recognizes the user, the computer then accesses audio preferences which can be stored in computer Memory **22**. Those preferences are then transmitted to Audio system **700**.

15   Pre-stored user specific preference settings for volume, balance, fade and tone of the outputted audio adjust the various subsystems such as Volume subsystem **710**, Balance subsystem **720**, Fade subsystem **730** and Tone subsystem **740**. In addition, user-defined preferences

20   stored in Memory **22** would determine which output device the user has chosen to listen to and transmit that information to Selector **750**, which then activates the appropriate device, either radio or CD or tape. Once that device is activated, it in turn accesses the tape

25   and selection or CD and selection from the CD/Tape Carousel subsystem **760** or the AM/FM Station Frequencies subsystem **770** and plays the appropriate selection which the user has predefined and stored in Memory **22**.

Docket No. AT9-98-916

In addition, as the user operates the vehicle, Systems Monitoring system **290** continually monitors manual adjustments by the user to each one of these subsystems. Those adjustments can be used to update the user

5   preferences in the onboard system Memory **22**. When the user exits the vehicle, these preferences may be used to replace the previous user specific preferences stored in Memory **22** or may merely be decimated in favor of the pre-stored user specific preferences in Memory **22**.

10   **Figure** 8 illustrates Safety system **800** as implemented in the present invention. Safety system **800** is contained within the dashed lines of **Figure** 8. Safety system **800** of the present invention is authorized only for higher security level users than the systems

15   discussed thus far. Therefore, as the user accesses Onboard Computer **20** via User Interface **28**, the user ID supplied by the user is ascertained by Onboard Computer **20**. The user ID is then compared to a list of IDs to ascertain the level of security that is authorized for

20   the user associated with this particular ID. Again, as in the other systems described above, Onboard Computer **20** would then authorize the user's ID number and retrieve user specific parameters from system Memory **22**. The user is granted access to Safety system **800** only if the user

25   is authorized for a higher level of security than the normal user. Therefore, Onboard Computer **20** will only grant control of Safety system **800** to users possessing a master or higher level of security authorization. The user specific parameters would be accessed and applied to

Docket No. AT9-98-916

the various subsystems within Safety system **800**. Safety
system **800** contains various subsystems which relate to
the safety of the vehicle. Those subsystems include:
Airbags **810**; Antilock Braking **820**; Warnings, Gauges and

5   Lights **830**; Passenger Restraints **840**; Exterior Lights
850; Spark and Fire Abatement **860**; and Collision
Avoidance subsystem **870**.

        In one embodiment, Airbags **810**, may be either
enabled or disabled depending upon the user's preferences

10   or safety needs. For instance, in normal user mode all
of the airbags in the car would be active. However,
certain users with access to the necessary security level
may disable certain airbags via Airbags subsystem **810**.
In cases where a parent always drives with a young child

15   in a car seat, the airbags adjacent to the car seat might
be disabled by setting the appropriate user specific
preferences. Alternatively, the user or certain
passengers might be of such slight stature that
deployment of the airbags may be more hazardous than the

20   accident itself, especially in a low-speed accident. In
that case, that user may prefer to disable one or more of
the airbags in the passenger compartment via Airbags
subsystem **810**.

        Other preferences might disable antilock braking for

25   certain users via Antilock Braking subsystem **820**. Also,
Warnings, Gauges and Lights subsystem **830** may have
preferences as far as warning defaults and the like, to
be set depending on the user's preferences. These may
consist of configuring graphic displays to setting

Docket No. AT9-98-916

warnings messages as either visual, text, voice or audio
warnings. Passenger Restraints subsystem **840** might be
set to require all passengers to be fully restrained
before the vehicle will move. One method of implementing

5   this requirement totally within Safety system **800** would
be for vehicle Antilock Braking subsystem **820** to engage
the brakes, thereby prohibiting the vehicle from moving
until all passengers are fully restrained.

   Other subsystems include Exterior Lights subsystem

10   **850,** which monitors and controls the exterior lights.
Therefore, when an exterior light burns out or is
damaged, Systems Monitoring system **290** immediately
communicates the status to Onboard Computer **20,** and the
information is conveyed to the user via User Interface **28**

15   or through Warnings, Gauges and Lights subsystem **830.**
Another subsystem important to safety is Spark and Fire
Abatement subsystem **860.** While most terrestrial vehicles
possess only minimal spark and fire subsystems, aircraft
and marine vehicles require more sophisticated spark and

20   fire abatement subsystems because of the lack of
alternatives to operators of non-terrestrial vehicles.

   Another subsystem important to the safety of
operation is Collision Avoidance subsystem **870.** Because
collision avoidance is one of the most rapidly changing

25   safety items on a vehicle today, even more advancement in
the area of collision avoidance is expected in the
future. A collision avoidance subsystem may be further
partitioned into front and rear subsystems or even into
xyz direction subsystems for vehicles that do not travel

Docket No. AT9-98-916

along a plane. In one embodiment, Collision Avoidance subsystem **870** is linked inexorably to Antilock Braking subsystem **820**, Passenger Restraints subsystem **840** and Airbags subsystem **810**. In addition, Collision Avoidance

5 subsystem **870** is connected to Communications/Interface system **500**. Collision Avoidance subsystem **870** will continually monitor the vehicle's position with respect to the positions of all other vehicles and obstacles in the proximity of the vehicle. Once the possibility of a

10 collision is detected by Collision Avoidance subsystem **870**, Collision Avoidance subsystem **870** attempts to warn the operator through Warnings, Gauges and Lights subsystem **830** using audible and visible alerts intended to make the operator aware that a collision involving

15 this vehicle is likely.

At some point before an imminent collision, Collision Avoidance subsystem **870** may act autonomously to avoid the collision. For instance, Collision Avoidance subsystem **870** may set the antilock brakes via Antilock

20 Braking subsystem **820**. Collision Avoidance subsystem **870** may also communicate to the local authorities via Communications/Interface system **500** that a collision involving the vehicle is likely or imminent. Collision Avoidance subsystem **870** may also allow airbags to deploy

25 faster by using Airbags subsystem **810** in combination with Collision Avoidance subsystem **870**. Then, rather than relying on the airbags to deploy in response to impact sensors along the bumpers and sides of the vehicle, the user modifies the user specific parameters associated

Docket No. AT9-98-916

with Collision Avoidance subsystem **870** to deploy the
airbags when the vehicle reaches a threshold proximity to
the obstruction. Therefore, rather than the airbag being
triggered by a certain amount of front or rear-end

5   deformation of the vehicle, the airbag deployment is
triggered just before the vehicle impacts with the
obstruction, thereby saving valuable milliseconds in
deployment. Also, changing the user specific parameters
to deploy airbags sooner allows for lower speeds of

10   acceleration within the airbags, which has been
determined to be advantageous to smaller and lighter
users and passengers.

Another embodiment of the present invention, Theft
Deterrence and Recovery subsystem **210**, might be connected

15   with both Antilock Braking subsystem **820** and Exterior
Lights subsystem **850**. This combination would allow Theft
Deterrence and Recovery subsystem **210** to activate certain
exterior lighting configurations and/or antilock brakes
at certain times during a vehicle theft. In one example,

20   the user may pre-set certain user specific parameters
that would allow a vehicle theft to occur only in certain
places. For instance, it might be that the user would
allow the vehicle to be stolen from the user's home but
not the user's place of business. This is an important

25   safety consideration, being that there is a likelihood of
violence occurring during a frustrated theft attempt.
Therefore, in attempt to avoid frustrating a potential
vehicle thief at the user's home, the user may elect to
allow the vehicle to be stolen and then alert the local

Docket No. AT9-98-916

authorities via Communications/Interface system **500**. In
addition, Theft Deterrence and Recovery system **210** could
reconfigure certain exterior lights that are not visible
to the present unauthorized operator. For instance, a

5   vehicle that is being operated by an unauthorized user
might be configured to flash one exterior brake light
each time the brake pedal is pressed. Therefore,
authorities witnessing a flashing rear brake light might
have reasonable suspicion to stop such a vehicle and

10   inspect it. In another embodiment, the Antilock Braking
subsystem **820** may be set to trigger the brakes upon the
unauthorized user traveling one or two miles from the
user's home. In that case, the vehicle would become
completely inoperable and the unauthorized user would

15   hopefully abandon the vehicle. Thus, the vehicle would
be available for safe recovery.

Figure 9 illustrates Engine Performance system **900**
as related to the present invention. Like Safety system
800, Engine Performance system **900** requires higher level

20   security for authorization by Onboard Computer **20**. User
preferences are stored in Onboard Computer **20** system
Memory **22** just as in the cases described above. Engine
Performance system **900** consists of several possible
subsystems, including Engine RPM (i.e., revolutions per

25   minute) subsystem **910**; Vehicle Speed subsystem **920**;
Vehicle Acceleration subsystem **930**; Engine Emissions
subsystem **940**; Fuel Miser subsystem **950**; and
Load/Altitude Adjustment subsystem **960**. Once the user is
identified to Onboard Computer **20** via User Interface **28**,

Docket No. AT9-98-916

Onboard Computer **20** analyzes the user ID to ascertain the user's security level.

If the user has a sufficiently high security level, as authorized by Onboard Computer **20**, then the user may reset the user specific parameters for the engine performance subsystems in Engine Performance system **900**. It would be conducive to safe operation of the vehicle for certain users who do not possess the necessary skill, age or expertise to operate the vehicle safely, to be limited by the vehicle's performance. One way to limit the vehicle's performance is by limiting or restricting the engine's RPM via Engine RPM subsystem **910**. The engine might only be allowed to rev up to a certain level, say 4000 RPMs. Such a limitation would be advantageous where there is a possibility that a younger user might have the tendency to race an engine at a stoplight or in a garage to extremely high RPM levels which could damage the interior components of the engine. Another important aspect of the present invention is limitation of the vehicle's speed via Vehicle Speed subsystem **920**. Invariably, speed is an important factor in both the frequency and severity of on-the-road accidents. By limiting the vehicle's speed for novice users, the number and severity of these accidents can possibly be decreased. This is also an important concept for vehicles other than on-the-road vehicles, such as airplanes and marine vehicles.

Vehicle acceleration is another important component of a vehicle safety program. If vehicle acceleration is

Docket No. AT9-98-916

limited via Vehicle Acceleration subsystem **930**, the user can only accelerate the vehicle at a certain rate. This reduces the likelihood that younger users who enjoy the fast take-off from a red light or stop sign would

5   participate in such activities. In the case of other vehicles, such as aircraft and marine vehicles, vehicle acceleration may also be measured in deceleration. Extremely rapid deceleration in an airplane or boat can cause the vehicle to become unstable. For instance, in

10   an aircraft extremely rapid deceleration may cause the aircraft to flip or go into a spin that is not recoverable because the vehicle's forward momentum has been lost. Extremely rapid deceleration of a boat causes a wake of water to come over the stern of the boat, thus

15   swamping the vehicle. Therefore, extremely rapid deceleration in aircraft or marine vehicles is highly undesirable.

Another subsystem controlled by Engine Performance system **900** is the Engine Emissions subsystem **940**. While

20   Engine Emissions subsystem **940** would generally be inaccessible to the vehicle's operators, it might be advantageous to reduce engine emissions even further below the Environmental Protection Agency (EPA) recommended standards. Therefore, on certain days such

25   as smog alert days and the like, engine emissions may be set to an even stricter standard via Engine Emissions subsystem **940**. Clearly this would have a detrimental effect on the performance of the vehicle and would not be appreciated by certain users. In a similar manner, Fuel

Docket No. AT9-98-916

Miser subsystem **950** may be set to require the vehicle's overall performance to maintain a certain vehicle fuel mileage. Although the vehicle operator may be allowed one or two quick accelerations, thereafter the

5   performance of the vehicle would be strictly limited to make up for those accelerations and maintain the overall fuel efficiency of the vehicle.

Finally, Engine Performance system **900** contains Load/Altitude Adjustment subsystem **960**. Load/Altitude

10 Adjustment subsystem **960** would change the engine's performance depending upon the altitude of the vehicle and the load the vehicle is carrying. Thus, when the vehicle is heavily loaded, as in the case of a truck pulling a boat, the vehicle performance characteristics

15 would change from being a faster or faster accelerating vehicle to that of being a vehicle that is more adept for towing, especially up hills, boat ramps and the like. This, of course, would be at the expense of other performance characteristics in the subsystem.

20   As in Safety system **800**, Engine Performance system **900** would be inexorably linked to Theft Deterrence and Recovery subsystem **210**. Once Theft Deterrence and Recovery subsystem **210** detected an unauthorized user, the engine performance parameters stored in Memory **22** would

25 set Engine Performance system **900** to levels that would make the vehicle inoperable. For instance, Vehicle Speed **920** parameters might be set to limit the vehicle to zero speed, and Engine RPM subsystem **910** might be set to limit the engine to zero RPM. Also, Vehicle Acceleration

Docket No. AT9-98-916

subsystem **930** could be set to zero. Thus, the vehicle's engine would be rendered inoperable.

The process of the present invention as described with respect to **Figures 1** to **10**, will now be discussed
5   with respect to **Figures 11** to **13**.

Another important aspect of the present invention is how the user interfaces with Onboard Computer **20**. **Figure 10** illustrates the user interface system as implemented in the present invention. User Interface system **28** may
10   employ a variety of different subsystems, singularly or in combination with each other. One of the exciting new concepts to be available involves SmartCard **1015** and SmartCard Reader **1010**. SmartCards are well known in the industry and will not be described in detail here; but
15   for the purpose of this invention, SmartCard **1015** contains at least Memory **1016** which is read by SmartCard Reader **1010**. When a user enters the vehicle, the user is identified by swiping SmartCard **1015** in SmartCard Reader **1010**. Onboard Computer **20** recognizes the input from
20   SmartCard Reader **1010** and accesses Memory **22** for information concerning the user. In one embodiment, Onboard Computer **20** merely checks the data available from Memory **1016** on SmartCard **1015** with the data for the particular user stored in onboard system Memory **22**. In
25   other embodiments, Onboard Computer **20** works in concert with a processor (not shown) on SmartCard **1015** in a series of ID verification steps designed to authorize the user.

Docket No. AT9-98-916

Another advantage of SmartCard **1015** is that
SmartCard Memory **1016** may contain other than merely
numeric data. Memory **1016** may include all data
pertaining to the owner of the SmartCard, including all
5   user specific preferences applied in setting the various
functions and sub-functions of the vehicle. Memory **1016**
might also include user identification data such as the
user's fingerprint pattern, the user's voice print
pattern, the user's iris print pattern or the user's
10   handwriting pattern. In one example, the card could
actually initiate the authorization process via Onboard
Computer **20**. The user would then be required to confirm
identity on a second user interface, such as Fingerprint
Reader **1020**.

15   Importantly, SmartCart Memory **1016** can be used to
store user specific parameters for one vehicle or for
several vehicles. In that same way, Memory **22** may store
the user specific parameters for all users authorized to
operate the vehicle.

20   System fraud and vehicle theft could be greatly
reduced if the intended user who has authorized SmartCard
1015 could also be confirmed as the actual operator of
the vehicle. The surest way to achieve this goal is to
register some biological attribute of the user with the
25   vehicle interface. The most widely used biological
attribute that identifies users is their picture. The
second most useful, and probably the easiest for an
onboard system to analyze, would be a user's fingerprint.
In another embodiment of the present invention, once

Docket No. AT9-98-916

SmartCard **1015** is read by SmartCard Reader **1010** and
authorized by Onboard Computer **20**, the user is then
required to input User's Finger **1025** via Fingerprint
Reader **1020**. Onboard Computer **20** then compares the
5   user's fingerprint pattern to either a fingerprint
identified with the user's data stored in onboard Memory
22 or stored on SmartCard Memory **1016**. Once the user has
been identified by Onboard Computer **20** as the rightful
possessor of the SmartCard **1015**, Onboard Computer **20** then
10   allows the user to access the highest level of security
authorized within Onboard Computer **20**.

Verification of a user's ID may be accomplished by a
number of other means, including Touch Pad **1060** or Number
Pad **1070** via Graphical User Interface (GUI) **1080**. While
15   GUI **1080** is advantageous, it is not essential to practice
the present invention. In fact, GUI **1080** may include
Touch Pad **1060** or it may not, or it may include Number
Pad **1070** or it may not, or any one of the three could be
used in combination. In another embodiment, the present
20   invention may require user identification via a voice
print stored in system Memory **22** or on SmartCard **1015**
Memory **1016**. In that case, User Interface system **28**
includes Microphone **1030**. The user interfaces with the
system by inputting User's Voice **1035** to Microphone **1030**
25   and then Onboard Computer **20** compares the voice pattern
with that of the user's voice pattern stored in system
Memory **22** or SmartCard **1015** Memory **1016**.

Other possible means of verifying the user's
identity include the user's iris pattern. In this case,

Docket No. AT9-98-916

CCD Camera **1040** would input an image of User's Eye **1045** to Onboard Computer **20** for analysis and comparison with an iris pattern stored in system Memory **22** or on SmartCard Memory **1016**. In another embodiment, User

5   Interface **28** might include a sample of the user's handwriting within system Memory **22** or within SmartCard Memory **1016**. The user would input a pre-determined sentence or series of words on Touch Pad **1060** as directed by the output of GUI **1080**. Onboard Computer **20** then

10   compares that series of slashes and gestures with the pattern stored in system Memory **22**.

In another embodiment of the present invention, the user is merely required to enter the proper personal User's PIN **1075** via Number Pad **1070**. Although generally

15   the personal identification number is an unchanging number that the user always possesses, recently and with the advent of GUIs, the personal identification number is more than merely a number. For instance, the personal identification number can actually be an operation the

20   user applies to a number, or an 'algorithmic password.' An example of an algorithmic password is to display a number to the user, such as '1234,' via GUI **1080**. An algorithm known only to the user might be to subtract each of the outside digits from 10 and transpose the two

25   inner digits. Thus, in response to seeing the number '1234,' the user inputs the number '9326' on GUI **1080**. Even someone watching the user input that number would have no idea what algorithm the user applied to the display number, as the operation is known only to the

Docket No. AT9-98-916

user.   More complicated algorithms can be formulated to test the dexterity of the user.   Such dexterity tests are well known as effective in deterring intoxicated users and users who are incapable of safely operating a vehicle

5   due to lack of sleep or illness.

In the final embodiment, User Interface **28** may include Breathalyzer **1050** to test User's Breath **1055** for alcohol content.   A user that has been prone to drive while under the influence of drugs or alcohol would be

10   required to demonstrate sobriety before being allowed to operate the vehicle.   In this case, User's Breath **1055** can be analyzed by Onboard Computer **20** to detect the presence of known intoxicants.   The user may be given several opportunities to pass the breathalyzer test

15   before the user is de-authorized and the vehicle is disabled by Onboard Computer **20**.

Finally, a user possessing a sufficiently high security level, such as a master user or an administrator, may authorize subsequent identification

20   verification by proxy, thereby allowing access to certain onboard systems by users which have been denied access on a verification basis.   This is an important feature for resolving identification verification problems brought about by failure of an identification verification

25   subsystem.

An important aspect of the present invention is that one or all of these identification verification subsystems can be included in User Interface system **28**. The advantage of SmartCard **1015** is that it contains

Docket No. AT9-98-916

Memory **1016**, which can be updated and obliterated while not in contact with Onboard Computer **20**. Unlike onboard computer Memory **22**, SmartCard **1015** can be read and updated while the user is not in the vehicle, in fact

5   while the vehicle is not even in the user's possession. Therefore, the user specific preferences stored on SmartCard Memory **1016** can be updated by someone other than the user, placing the user at the mercy of the fleet dispatcher or vehicle owner or parents, or whomever is

10 ultimately responsible for the vehicle. Also, the SmartCard might contain user preferences for a variety of different vehicles.

.Alternatively, SmartCard Memory **1016** contains user specified parameters in an independent device format. By

15 using an independent device format for storing user specified parameters, the user may set specified parameters which are desired for use by a variety of different vehicles and vehicle types. The device-independent parameters would then be transformed into

20 device-dependent parameters by the onboard computer of any vehicle in which the SmartCard is inserted. While some parameters may require some fine tuning or tweaking once the user becomes accustomed to each different vehicle, the majority of the user specified parameters

25 will fulfill the user's expectations without tweaking. Tremendous memory savings are achieved by storing user specific parameters in device-independent format on the SmartCard. Rather than storing multiple sets of user specific parameters on a variety of different vehicles,

Docket No. AT9-98-916

the one set of user specified parameters which is stored on the SmartCard is transformed into device-dependent parameters by any onboard computer of a specific vehicle into which the SmartCard is inserted.

5   **Figure 11** depicts another embodiment of Audio system **700** as defined by the present invention. In **Figure 11**, Audio system **700** is further divided into various subsystems of the present invention which were delineated in **Figure 7** as Volume subsystem **710**, Balance subsystem

10   **720**, Fade subsystem **730**, Tone subsystem **740** and Selector subsystem **750** and which are now combined in Audio Output Control subsystem **775**. In addition, the present invention now includes Audio Event Programming subsystem **780**, Audio Event Scheduling subsystem **785**, Audio Event

15   Retention subsystem **790** and Audio Event Memory subsystem **795**. Audio system **700** still contains CD/Tape Carousel subsystem **760** and AM/FM Station Frequencies subsystem **770**.

The process of the present invention is illustrated

20   in **Figure 12**. The process starts at step **1205**. The user enters the user's ID via Touch Pad **1060** of GUI **1080** or Number Pad **1070** of GUI **1080**. Alternatively, the user may swipe SmartCard **1015** into SmartCard Reader **1010** (step **1210**). A menu of the available audio programs is then

25   displayed to the user via User Interface **28** (step **1215**). In one embodiment of the present invention, the user is then required to enter the radio frequencies or call signs of the radio stations the user requires the system to scan for the audio events to be acquired in later

steps (step **1220**). The user then prioritizes the radio events which are to be recorded or memorized by topic (step **1225**). The topics that are to be recorded are then further prioritized by title (step **1230**). Alternatively

5   or additionally, rather than selecting audio events by topic and by anticipated title and having the radio automatically scan frequencies for airings of those events, the user may select the specific title of a preferred radio program (step **1235**). The user may then

10 enter the radio frequency and the time that this program will be aired (step **1240**). The user may then select other titles (step **1250**) by repeating the process at step **1235** until no other titles are to be selected. This type of programming is similar to programming a VCR to record

15 favorite television programs. The process then passes control to step **1260** where the user may store the settings, indexed by the user's ID (step **1260**). If the user is unhappy with the settings the user may return to step **1215** and repeat the process. On the other hand, if

20 the user is happy with the selections the process ends at step **1270**. While the process illustrated in **Figure 12** is similar to that of programming VCR recordings, generally the user plays back VCR recordings at leisure so no playback mode specifications are necessary.

25   In **Figure 13A**, the process starts at step **1300**. At step 1305, the user enters a unique user ID or user SmartCard as described above with respect to **Figure 12**. GUI **1080** displays the user menu at step **1310**. Next, the user is required to prioritize the playback scheduling of

Docket No. AT9-98-916

radio events by topic (step **1320**). This information is used by Audio Event Scheduling subsystem **785** for scheduling audio events by topic. The user then prioritizes the playback scheduling of topics by title (step **1330**) and Audio Event Scheduling subsystem **785** uses this information to further refine the schedule of playback for this specific user.

The user is then required to prioritize the retention of radio events by topic (step **1340**). Prioritizing the retention of radio events enforces a strict regiment that deletes lower priority information stored in Audio Event Memory subsystem **795**. Certain events are more important to certain users than other events that may nonetheless be more important than yet other events. For instance, a current weather forecast is extremely important topically as are certain news broadcasts. However, a weather forecast is no longer current and therefore of virtually no importance the following day, especially when taken from the perspective of the vehicle operator whose objective is to navigate through current weather conditions. Therefore, in one example, weather forecasts would be retained only as long as they are current and automatically overwritten by the next available weather forecast. In the case of news broadcasts, on the other hand, the system may retain two or three previous news broadcasts along with the current news broadcast or, in other embodiments, the user may select to retain only the most recent news broadcast. Other programs, such as information programs, may be

Docket No. AT9-98-916

retained for a number of weeks. For instance, an event

that airs weekly, such as a political round table talk,

might be current but also still useful some weeks after

the time it is aired and, therefore, might remain in

5   Audio Event Memory **795** for several weeks. Other radio

event topics, such as home improvement, self improvement,

panel discussions or vehicle maintenance, might remain in

Audio Event Memory **795** much longer even if they are not

particularly topical but are designated as relatively

10   important to a particular user. The user is then

required to prioritize retention of the topics by title

(step **1350**). Therefore, within a certain topic, such as

car repair, the user may have several radio programs to

select from within a week's time. The user may

15   particularly care for one or two of the programs and yet

not care for the rest of them. Conveniently, the system

would prioritize programming depending on the user's

preference by title.

Although other implementations of the present

20   invention are possible, it is important to note that this

system gives the user extreme flexibility in both

recording a particular program and playing back that

particular program. For instance, if the user especially

cares for a particular child development panel discussion

25   program that is aired at a certain time and does not

particularly care for a second child development program

that is aired at a different time, the user can

prioritize the recording of these two events as

illustrated in **Figure 12**. If the program the user enjoys

Docket No. AT9-98-916

is not aired or cannot be recorded, the system may still record the second program. Then in playback mode, if the user enjoys the topic of child care over any other topic of radio program, even though the user's favorite child

5   care program has not been recorded, the system may schedule in its place the playback of a child care program having a lower priority.

Next the user selects a playback format for radio broadcast events by topic (step **1360**). This selection is

10   performed by the Audio Event Programming subsystem **780**. The user then selects the playback format of particular topics by title (step **1370**). Next the user is asked whether or not the settings should be stored by user ID. If the user is unhappy with a selection, the process

15   returns to step **1320** to reinitialize the system (step **1380**). If the user's selections are acceptable the process ends at **1390**.

Figure 13B illustrates the playback mode of the present invention in more detail. Steps **1300** to **1310**

20   correspond to steps **1205** through **1215** of the previous illustration in **Figure 12**. The user prioritizes the playback scheduling of radio events by topic at step **1320**. The user then selects the playback topic priority scheduling, such as immediate, important, informational,

25   entertainment or on-demand, in order to prioritize the scheduling of a specific topic (step **1325**). The process then returns to step **1320**. If no further prioritizing is requested by the user, the process passes to step **1330**. There the user prioritizes playback scheduling of topics

Docket No. AT9-98-916

by title by ranking the particular titles within a topic on some scale (between 1 and 100 is exemplary) (step **1335**). The process then passes back to step **1330**. If no more titles are requested to be prioritized, the process

5 passes to step **1340** where the user prioritizes the retention of radio events by topic. If the user intends to select topic retention, the user specifies the number of hours the topic should remain resident in Audio Event Memory **795** (step **1345**).

10 Once the retention rankings of all topics have been selected and the number of hours the topics should remain resident in memory have been determined, the system passes the process back to step **1340**. If the user is satisfied with the selections for the retention of radio

15 events by topic, the system then passes the process to step **1350** where the user is asked to prioritize retention of topics by title. If the user has a preference for certain titles within topics, the user may rank those titles as being permanent, store until played, store as

20 current or store until playback (step **1355**). Thus, titles of topics remain in Audio Event Memory **795** only as long as the user intends and certain titles of topics may remain resident in Audio Event Memory **795** on a permanent basis or until the user intends to overwrite them.

25 Others remain in memory only until played automatically by Audio Event Scheduling **785** or until played manually by the user. Still other titles of topics stored as current are overwritten automatically when a new identical or similar broadcast is stored on the system memory. Still

Docket No. AT9-98-916

others are stored until playback, whether there is
another identical or similar title of topic in memory or
not. Once the user has prioritized title retention
preferences, the process returns to step **1350**. If no

5   more topics are intended to be prioritized by title, then
the system passes to step **1360**.

At step **1360**, the user selects a playback format of
radio events by topic. If the user has a preference, the
user selects a format of continuous playback,

10 discontinuous and replay playback, or discontinuous and
pick-up playback (step **1365**). For instance, a topic such
as a panel discussion on child care might be assigned a
format of discontinuous and pick-up. Thus, when the user
is listening to the selected topic, if a news or

15 information topic or title is recorded by Audio Event
Programming system **780**, the child care panel discussion
may be interrupted for presentation of the information
broadcast. Once the information broadcast is completed,
the child care program will pick up where it left off.

20 Alternatively, the user may select to hear an entire
program in one sitting. In this case, if a program
having a higher scheduling priority is received by Audio
system **700**, the ongoing program is interrupted for airing
of the higher priority program and then, rather than

25 being picked up from where it was interrupted, the
initially airing program is replayed from its beginning.
Other formats are possible; the above-mentioned formats
are merely exemplary.

Docket No. AT9-98-916

Once formats are selected, control is passed back to
step **1360**. If no more playback formats are to be
selected by topic, control is passed to step **1370**. The
other playback format of topics is selected by title. At
5   step **1375**, the user may select to re-rank certain titles
within a particular topic by designating a playback
format different from the entire topic. For instance,
higher priority events within the topic might be selected
to be played back as continuous rather than in some type
10   of discontinuous mode. Thus, while the topic playback
format might be designated as discontinuous and replay
mode, one or more of the radio events that are more
significant to the user might be selected for a
continuous playback format. Once the user has selected
15   all of the playback formats by title, control is passed
back to step **1370**. If no more formats are selected,
control is passed to step **1380** where the user is asked to
store the selected index by user ID. If the user is not
happy with the selections, control is passed back to step
20   **1320** for re-initialization of the process.
Alternatively, because the entire menu is being displayed
on GUI **1080** the user may select any step for modification
and return then to step **1380** to store the user settings
indexed by the user's ID. Once that is complete, the
25   process ends at step **1390**.

An important feature of the present invention is
that, while a vehicle remains idle, Audio Event Memory
795 may be continually updating broadcast programs
specified by the user. The vehicle could also be

Docket No. AT9-98-916

connected either to the fleet control via Fleet Docking
Port **540** or the user's home via Home Docking Port **560**.
This is extremely convenient for a user on a limited time
schedule. One example is the daily rush of the typical

5   commuter. Often the operator of the vehicle spends five,
ten or fifteen minutes of the morning routine catching up
on news, weather and traffic reports in order to plan a
route to the office or business. A system such as the
present invention, which automatically records these

10   reports and plays them back immediately upon the user
entering the vehicle, may save the user that five to
fifteen minutes early in the morning. Thus, when a user
enters the car and is identified to Onboard Computer **20**
via User Interface **28** by inputting a user ID number or

15   SmartCard as in step **1305**, the user is automatically
greeted by the local traffic report, news and weather.
Thus, almost before exiting the driveway, the user has a
good idea of what travel route is best at that time.
Such immediate availability of these reports is even more

20   crucial for operators of vehicles other than cars or
trucks. For instance, light aircraft and marine vehicles
are particularly susceptible to changes in weather. In
alternative embodiments of the present invention, news,
weather and traffic reports can be integrated with

25   Navigation and Tracking system **600**, and a travel route
for the vehicle automatically determined before the user
even enters the vehicle.

Finally, vehicle operators who are routinely
required to traverse long distances will have a steady

Docket No. AT9-98-916

stream of current and topical information from which to
select. As the vehicle moves into and out of broadcast
coverage areas, the vehicle itself contains a menu of
programming that the user has pre-selected in Audio Event
5   Memory **795**. Therefore, rather than the user manually
switching stations or flipping back and forth from CD to
radio, or merely changing tracks and titles on the CD,
tape and radio, these events are programmed and
prioritized by the user in order to give the user the
10   best combination of topics and titles available.

In still other embodiments of the present invention,
the user may selectively reduce the amount of content in
any one event, topic, or titles within the topics. For
instance, the user may select to have a particular
15   program recorded by Audio Event Memory **795**, commercial
free. Audio Event Programming **780** identifies commercials
during the program and switches off Audio Event Memory
795 during the airing of the commercials. In other
embodiments, Audio Event Programming **780** may selectively
20   compress certain audio events. Thus, the playback length
of certain events, such as panel discussions, may be
reduced by 10 percent or so from the original broadcast
length. While the user may notice some increase in pitch
of the voices of these panel participants, the overall
25   audio quality would be acceptable.

In a final embodiment of the present invention, the
program retention and playback formats are indexed by
user ID. Audio Event Memory subsystem **795** must contain
enough space for several users. As a user enters the car

Docket No. AT9-98-916

and is identified by Onboard Computer **20**, the user's
audio preferences are acquired from system Memory **22** and
implemented through Audio system **700**. It is assumed that
every user would have a unique set of preferences and

5   very little overlap among users would occur. Therefore,
at some point, especially if a number of different users
operate the same vehicle, Audio Event Memory **795** would
become full. In a further embodiment, the users would be
prioritized. For instance, a user having a master

10 security level would be able to rank the priority of
other users. This could be done in a number of different
ways. For instance, high level users may have complete
priority over other users. Thus, if Audio Event Memory
795 is completely filled with programming events selected

15 by the master level user, no memory would be available
for other users. Alternatively, each user may be
assigned a pre-defined section of Audio Event Memory **795**
to be filled in any manner desired.

Finally, each user may be authorized to store only

20 events having high playback priority. Thus, topics
having immediate and important priority for each user may
be automatically given priority over any user's lower
priority playback scheduling parameters. Thereby, the
most important programming for each user would be

25 guaranteed available when the user enters the vehicle.

Figure 22 illustrates the audio data structure
implemented in the present invention. In a preferred
embodiment of the present invention, an audio data
structure **2200** is stored in a memory. The audio data

Docket No. AT9-98-916

structure may be indexed to the user and stored in
computer Memory **22**. Alternatively, audio data structure
2000 may be stored on a user's SmartCard in Memory **1016**
or may be stored in a memory contained in Audio subsystem
5   **700**. Audio data structure **2000** may be displayed on GUI
1080 or may be resident in one of the memories described
above. Audio data structure **2200** is meant as an example
of one possible embodiment and is in no way meant to
limit the practice of the present invention. Audio data
10   structure **2200** is broken down into several column groups:
broadcast event identification (group **2202**); a group of
record preferences (group **2204**); playback scheduling
preferences (group **2206**); memory retention preferences
group (group **2208**); and playback format preferences group
15   (group **2210**).

Audio data structure **2200** is compiled by using the
process described with reference to **Figures 12** and **13**
described above. In the present invention, header row
2212 identifies the contents of each of the columns.
20   Rows **2214** to **2226** illustrate the individual broadcast
events. Example row **2214** illustrates a news topic
identified in column **2213**. Column **2215** is blank, noting
that no title is to be given for the news. Therefore,
the user must either designate a frequency, and time and
25   day to record the topic, or the user may provide a
variety of frequencies or call signs which the system can
scan to locate the topic designated by the user.

Returning to row **2214**, the user designates the
frequency from which the program will be recorded. In

Docket No. AT9-98-916

this case, frequency **2217** is indicated as 590 AM. Other
record preferences **2204** include time **2221** and day **2219** of
the broadcast event airing. In the case of row **2214**, the
user has indicated to record Monday through Friday from
5   five minutes to ten minutes past the hour (columns **2219**
and **2221**, respectively).

   Next, the user indicates the playback scheduling
preferences from playback scheduling group **2206**.
Preferences generally correspond to the topic or title of
10   the program. In this case, the user has selected only a
topic, so the user then designates playback topic
priority **2223**. In this case, the user has entered
'important.' Playback title priority **2225** remains blank
because the user has not indicated a specific title.

15   Next, the user indicates retention parameters from
retention preferences group **2208**. First, the user enters
the length of time for which a broadcast should be
retained in memory. Again, priorities are generally
based on topic and then title of the broadcast event. In
20   the case of row **2214**, the news topic will be held for a
maximum of ten hours as indicated in topic retention
priority column **2227**. Again, title retention priority
2229 is blank because no title was indicated by the user
in title field **2215**.

25   The user can then designate number of copies to be
retained **2221**. In this case, only one copy need be
retained. Therefore, as a new news broadcast is
received, it writes over the old broadcast. Finally, the
user designates memory stacking parameters **2233**. In this

Docket No. AT9-98-916

case, the user has designated mono as the memory stacking parameter. However, the user may designate a number of parameters. For instance, the user may intend to store the program in stereo mode, which takes up much more

5   memory space. Conversely, the user may intend to store the recording as a compressed mono with a compressability factor determined by the percentage of memory saved. For instance, mono compressed 20 would save approximately 20 percent of memory space over normal mono stacking mode.

10   Final preferences for the user to select are the playback format preferences from playback format group **2210**. These preferences indicate how, or in what format, the broadcast event which is stored in memory will be played back. Playback topic format **2213** indicates that

15   the user selected discontinuous/pickup format. In this case, the news event will be played back. However, if the broadcast event is interrupted, making it a higher priority broadcast event, the broadcast event in **2214** will be picked up where it left off. Again, because no

20   title was specified, playback title format **2217** is left blank.

In another example, the user has selected a one-time event to be recorded on row **2226**. In this case, topic **2213** is listed as a one-time event. Title event **2215** is

25   listed as 'Clinton.' The user selected frequency **2217** for 590 AM, day **2219** for Monday, and time **2221** of between 8:00 p.m. and 10:00 p.m. The user has selected President Clinton's State of the Union Address to be recorded. The user selected playback topic priority **2223** as on-demand.

Docket No. AT9-98-916

This means that, unless the user specifically calls up
this broadcast event, it will remain resident in memory
until overwritten by a higher priority broadcast event.
However, the user selected a relatively high playback
5   title priority **2225** of 5. Therefore, the chances of the
Presidential address being overwritten by another program
are relatively slight.

The user selected the topic for retention priority
2227 as 50 hours. Therefore, that topic will be stored
10   for 50 hours unless title retention priority **2229**
contradicts topic retention priority **2227**. In that case,
title retention priority will take precedence, and in
this case, the user selected title retention priority
2229 as permanent. Therefore, the 50 hours selected on
15   topic retention priority **2227**, which will remain in force
for other one-time broadcast event topics as well, will
be circumvented by the selection of permanent for this
particular title.

The user selected one as the number of copies to be
20   retained **2223** and selected a memory stacking algorithm
2213 of mono compressed by 10 percent. The user then
selected discontinuous/pickup for playback topic format
2213; but as in the retention group parameters, the user
then selected playback title format **2237** as continuous
25   meaning that, although the general group will be played
back in continuous/pickup format, this particular title
will be played back continuously. Therefore, President
Clinton's State of the Union Address will not be

Docket No. AT9-98-916

interrupted by another program event, no matter the priority, unless the user manually intervenes.

It is important to note that while the present invention has been described in the context of a fully

5   functioning data processing system, those of ordinary skill in the art will appreciate that the processes of the present invention are capable of being distributed in a form of a computer readable medium of instructions and a variety of forms, and that the present invention

10   applies equally regardless of the particular type of signal bearing media actually used to carry out the distribution. Examples of computer readable media include recordable-type media such as floppy discs, hard disk drives, RAM, CD-ROMs, and transmission-type media

15   such as digital and analog communications links.

The description of the present invention has been presented for purposes of illustration and description but is not limited to be exhaustive or limited to the invention in the form disclosed. Many modifications and

20   variations will be apparent to those of ordinary skill in the art. The embodiment was chosen and described in order to best explain the principles of the invention and the practical applications, and to enable others of ordinary skill in the art to understand the invention for

25   various embodiments with various modifications as are suited to the particular uses contemplated.